Appendix D2

Application of the Metropolitan Planning Organization Travel Demand Model

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1.1 INTRODUCTION

The Alamo Area Metropolitan Planning Organization (formerly the San Antonio – Bexar County Metropolitan Planning Organization) (MPO) 2035 travel demand model was used to forecast future traffic volumes for various scenarios analyzed for the US 281 Environmental Impact Statement (EIS) project. Note, the MPO adopted *Mobility 2040* on December 8, 2014; however the travel demand model associated with this plan was not available at the time of this analysis. The 2035 travel demand model was the most current data available at the time. This memorandum documents the application of the 2035 travel model for the project.

1.2 MPO TRAVEL DEMAND MODEL

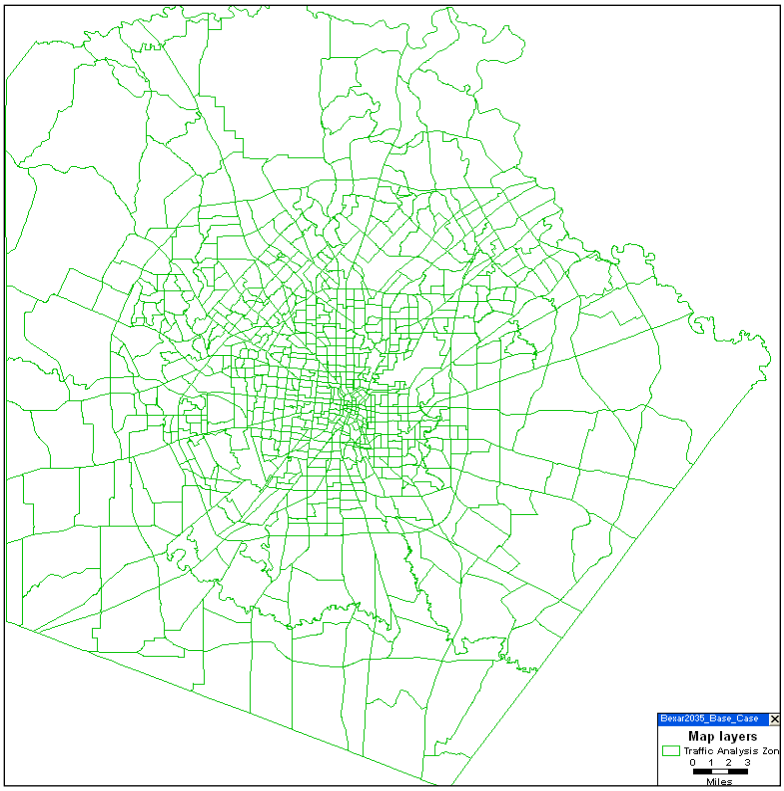
The MPO calibrated and validated the travel demand model to year 2008 conditions. The MPO provided the most current version of the 2035 travel model network and trip table for each successive stage of screening. Illustrations of the model are provided in the following figures:

- **Figure 1** displays the traffic analysis zone system.
- **Figure 2** displays the Year 2008 regional network.
- **Figure 3** displays the 2035 regional network provided by the MPO containing the region's planned improvements to the roadway system, including improvements to the US 281 Corridor.
- **Figure 4** displays the 2035 network in the vicinity of the US 281 project corridor area.

A primary input of the model is future estimates of population and employment, distributed geographically by Traffic Analysis Zone. The future socioeconomic data set used for the US 281 screening process was the MPO adopted 2035 socioeconomic data scenario (TOD + Infill) for the region. The "Current Trends" 2035 scenario was used for some sensitivity analyses to gain an understanding of the capacity needed under that socioeconomic scenario.

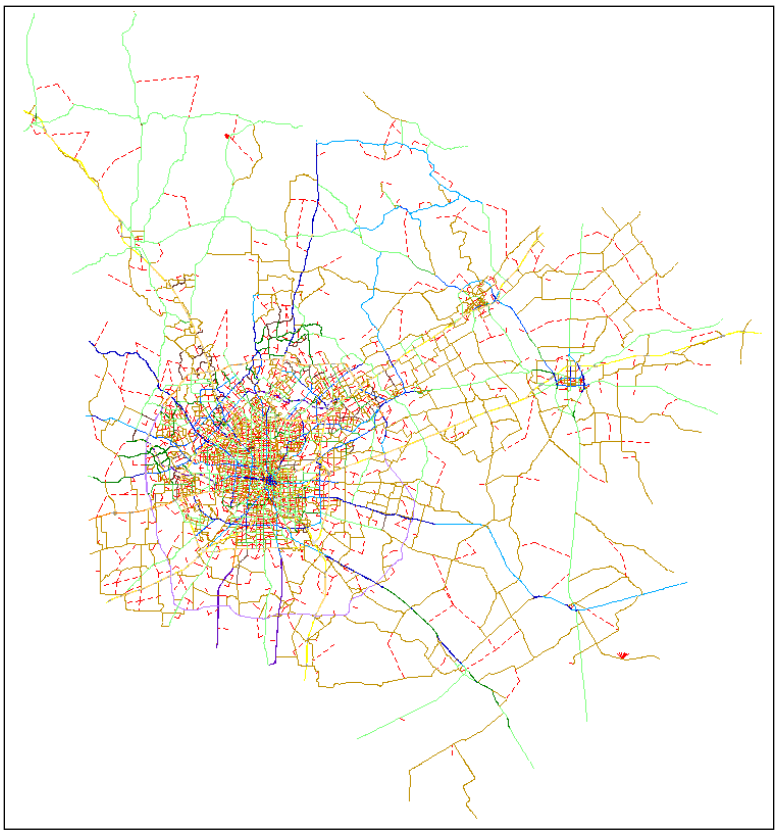
The travel model is capable of providing travel demand volume projections at a daily level. Peak hour results are limited to link speed and volume-to-capacity (v/c) ratios. The MPO model uses input parameters including speed and travel time based on observed congested – or peak hour – conditions. The model assigns trips to roadways under these peak conditions, and reports forecasted peak hour speeds and v/c ratios, and daily traffic volumes.

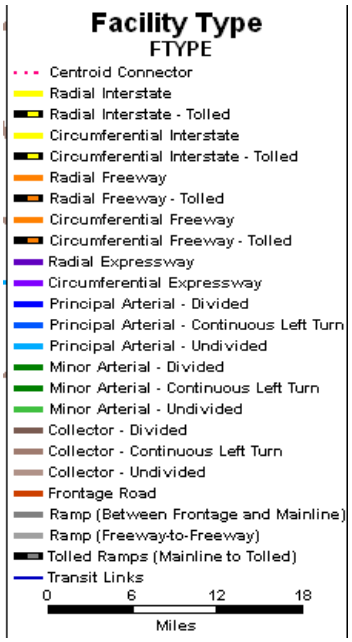
Figure 1: Traffic Analysis Zone System



Source: MPO Travel Demand Model, 2009

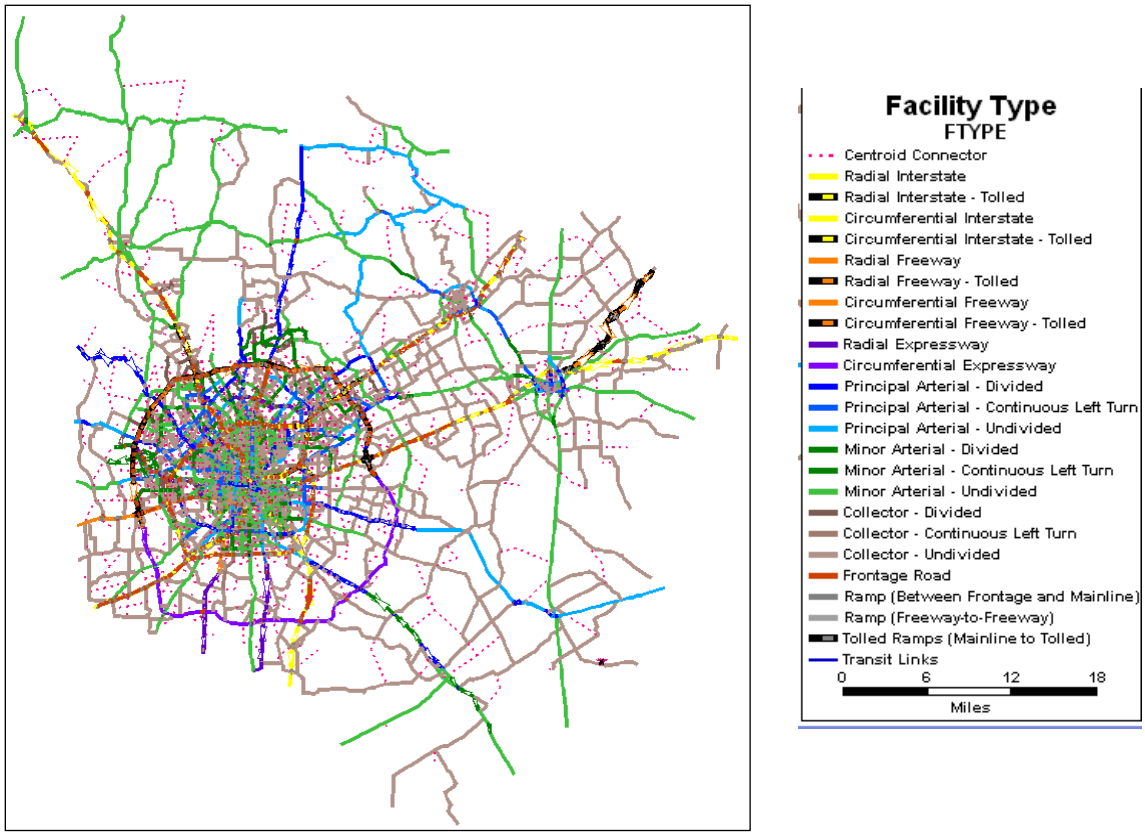
Figure 2: Year 2008 Model Network





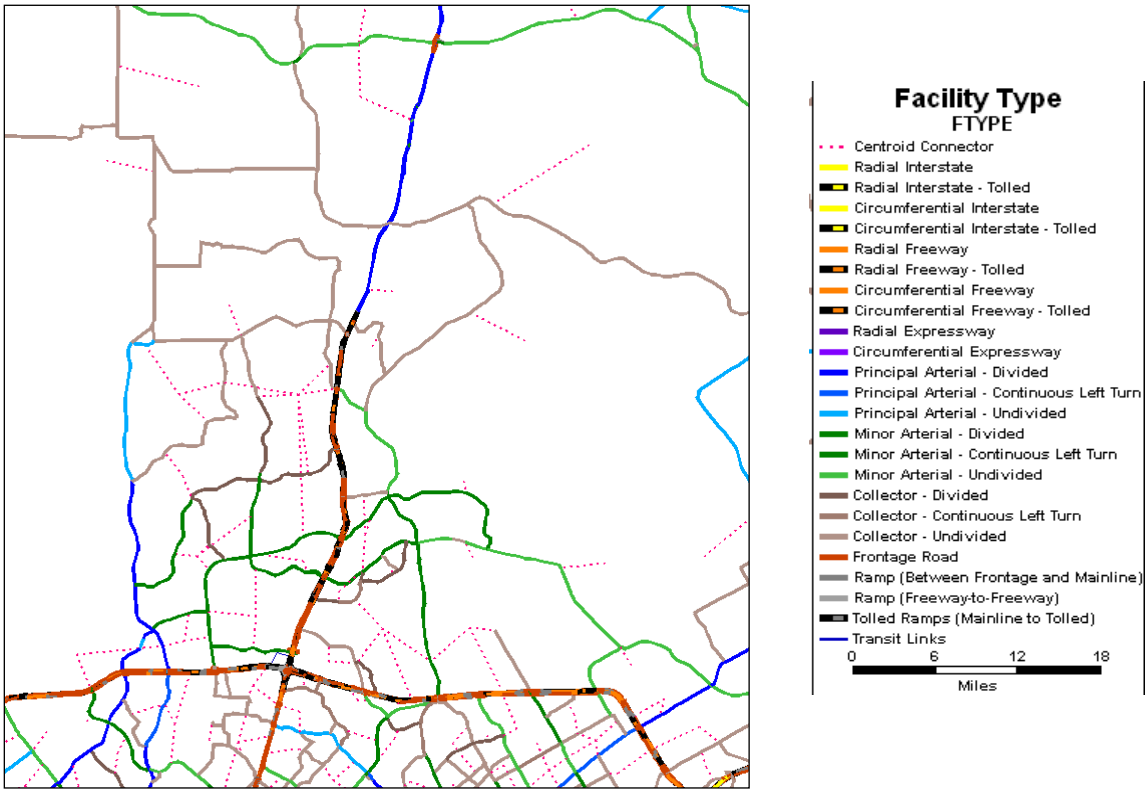
Source: MPO Travel Demand Model, 2009

Figure 3: Year 2035 Model Network



Source: MPO Travel Demand Model, 2009

Figure 4: Year 2035 Model Network – Study Area



Source: MPO Travel Demand Model, 2009

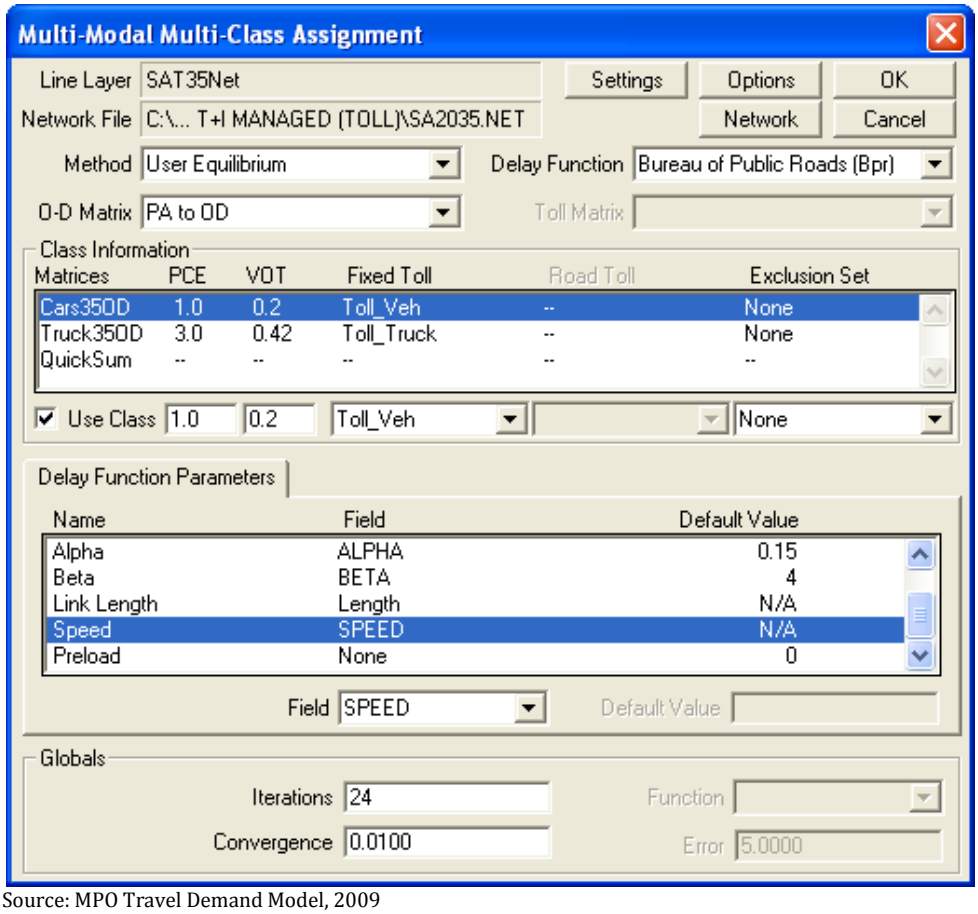
As with any simulation model, there are limitations to its capabilities. The US 281 project corridor is located towards the edge of the boundary of the regional model and the traffic analysis zones are relatively large. Large traffic zones inhibit the precision of the localized volume forecasts. The coded network of the MPO model includes frontage roads along freeways in locations as appropriate, but the model's assignment of traffic activity to these frontage roads needs to be checked for reasonableness. The model does not have a capability for estimating use of a high-occupant vehicle (HOV) facility. The model has a minimal procedure for estimating toll road volume, which is traffic assignment based. The toll procedure adds a cost in terms of travel time by converting an assumed toll rate per mile with value-of-time assumptions, for links coded as toll links.

1.2.1 Model Application

Model Operation

The model is implemented in the TransCAD software platform. TransCAD version 4.8, Build 500 or higher, was used for all modeling exercises. Alternatives were tested using the Multi-Modal Assignment procedures in interactive mode, according to instructions from the MPO. The parameters shown in **Figure 5** were used to run the model.

Figure 5: TransCAD Interactive Mode Parameters



Source: MPO Travel Demand Model, 2009

Coding Assumptions

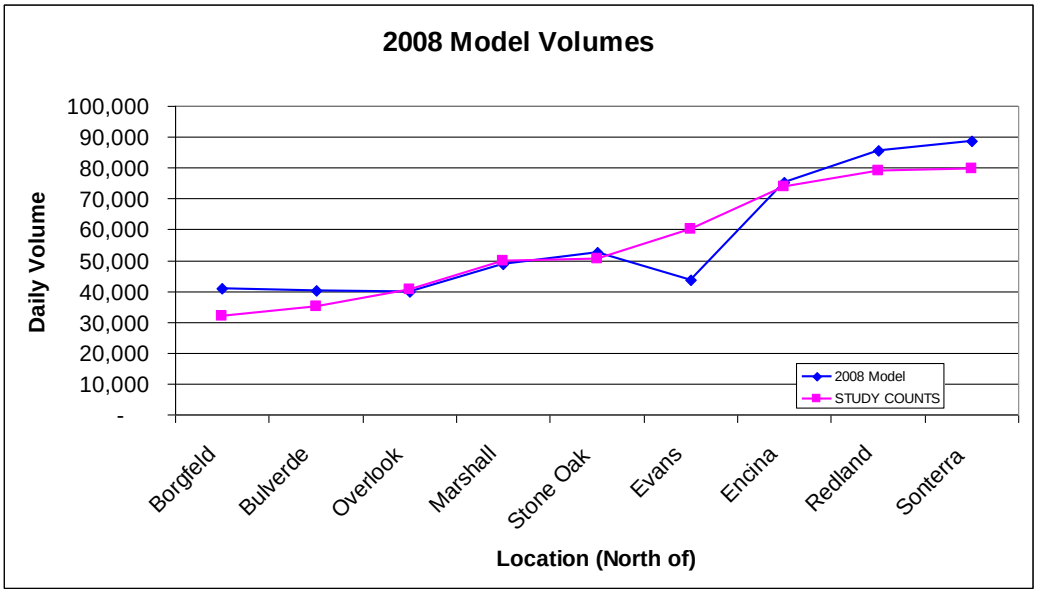
Roadway improvements for capacity and facility type were coded per guidance from the MPO. For toll links, the toll code was flagged with a value of time of $0.20 per minute ($12.00 per hour) and a toll rate of $0.15 per mile for autos and $0.40 per mile for trucks.

Because the model does not have HOV or Managed Lane (a lane that is restricted to tolled vehicles and high occupant vehicles) capabilities, managed lanes were coded as tolled expressways with the cost of the toll reduced by 50 percent. In addition for managed lanes, the vehicle trip table was reduced to account for the increased amount of carpooling due to the inclusion of HOVs on the managed lane facility. To determine the trip table reduction, a select link analysis was employed to determine the set of typical origin and destination zones that use the US 281 project corridor. This subset of the regional trip table was reduced by about 2,500 trips. This corresponded to about a 3% reduction of directional vehicle trips that use the US 281 project corridor. The basis for this amount was the reported mode share experience in Houston and Dallas.

1.2.2 *Interpretation of Model Results*

A review of the 2008 model volumes compared to observed traffic counts on the US 281 project corridor was performed. It was found that the daily link model volumes typically compared favorably with the observed daily counts, with some link-to-link variability. **Figure 6** displays the comparison of counts to model volumes along the US 281 project corridor.

Figure 6: 2008 Base Year Model Volumes vs. 2008 Counts



Source: Pape-Dawson, US 281 Super Street Study, 2009, US 281 EIS Team, 2010

1.3 LEVEL 2 AND 3 ALTERNATIVES MODELING

This section describes the modeling performed for Levels 2 and 3 alternatives screening. The travel model was not employed for Level 1 screening.

1.3.1 Source Travel Model

For Level 2 screening, the latest version of the travel demand model was provided by the MPO on October 21, 2009. For Level 3 screening, the MPO provided an updated model in the form of model sets for the years 2008 and 2035 on December 29, 2009. The transmitted 2035 model files were limited to origin-destination matrices and a geographic network file. These trip tables created by the MPO reflected the adopted 2035 socio-economic data scenario (TOD + Infill) for the region.

1.3.2 2035 No-Build Network Model

A No-Build network model is used as a baseline to compare several build alternatives. The network used for the model is defined to be the existing roadway system, together with committed improvement projects as planned by the MPO outside of the specific action being proposed. The 2035 network provided by the MPO was used as the base for the No-Build network. This network includes widening and upgrading the US 281 project corridor to a tolled expressway. This improvement was removed from the No-Build network, and the US 281 project corridor was re-coded to 2008 conditions. The detailed coding of the Super Street improvements was not included.

1.3.3 Level 2 2035 Build Networks

The 2035 Build networks were coded for several US 281 alternatives using the 2035 No-Build network as a base. Numerous alternative scenarios were simulated with the travel model to support the technical analysis for the US 281 Corridor Project. In Level 2, an initial set of model runs of alternatives were completed. **Table 1** provides a list and description of the modeling scenarios performed for Level 2 alternative screening.

Table 1: Level 2 Alternative Model Runs

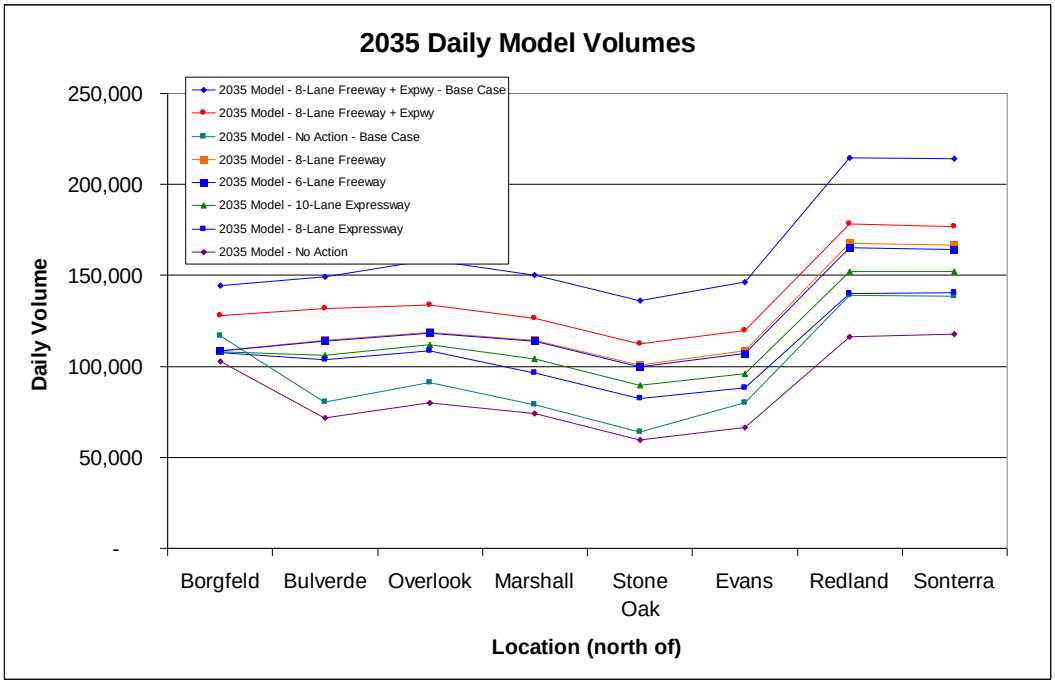
Run Name	Base Network	O-D Table	Improvements	Quality Check
2008 Base Test	2015 E+C	2008	None	Check
2035 2015 E+C	2015 E+C	2035 on 2015	None	Check
US-281_2035 F-1	2015 E+C	2035 on 2015	6-Lane Freeway between Loop 1604 and Borgfeld	Check
US-281_2035 F-2	2035 F-1	2035 on 2015	8-Lane Freeway between Loop 1604 and Evans; 6-Lane Freeway between Evans and Borgfeld	Check
US-281_2035 F-3	2035 F-2	2035 on 2015	8-Lane Freeway between Loop 1604 and Evans; 6-Lane Freeway between Evans and Borgfeld; 8-Lane Expressway between Borgfeld and Bulverde North	Check
US-281_2035 E-1	2015 E+C	2035 on 2015	8-Lane Expressway between Loop 1604 and Borgfeld	Check
US-281_2035 E-2	2015 E+C	2035 on 2015	10-Lane Expressway between Loop 1604 and Borgfeld	Check
2035 2015 E+C - Trends	2015 E+C	2035 on 2015 CT	None; Current Trends Land Use Adjustment	Check
US-281_2035 F-3 - Trends	2035 F-2	2035 on 2015 CT	8-Lane Freeway between Loop 1604 and Evans; 6-Lane Freeway between Evans and Borgfeld; 8-Lane Expressway between Borgfeld and Bulverde North; Current Trends Land Use Adjustment	Check
US-281_2035 CT Expressway Alternative	2035 SAM	2035 CT	Expressway Alternative as transmitted by Austin (12/02/2009); Current Trends Land Use Adjustment	Check
US-281_2035 T+I Expressway Alternative	2035 SAM	2035 T+I	Expressway Alternative as transmitted by Austin (12/02/2009); Adopted TOD + Infill (T+I) Land Use	Check
US-281_2035 T+I Expressway Plus Alternative	2035 T+I Expressway	2035 T+I	Sensitivity Test – Added 1 additional lane per direction	Check
US-281_2035 T+I Expressway Alternative (iteration2)	2035 T+I Expressway	2035 T+I	Expressway Alternative coded to match the recommended laneage.	Check

Source: US 281 EIS Team, 2010

1.3.4 Level 2 Results

Level 2 modeling aided in the development of Level 3 alternatives by providing general guidance on the needed number of lanes through the US 281 project corridor. A summary of daily volumes for the Level 2 alternatives is presented in **Figure 7**.

Figure 7: Level 2 Daily Traffic Projections

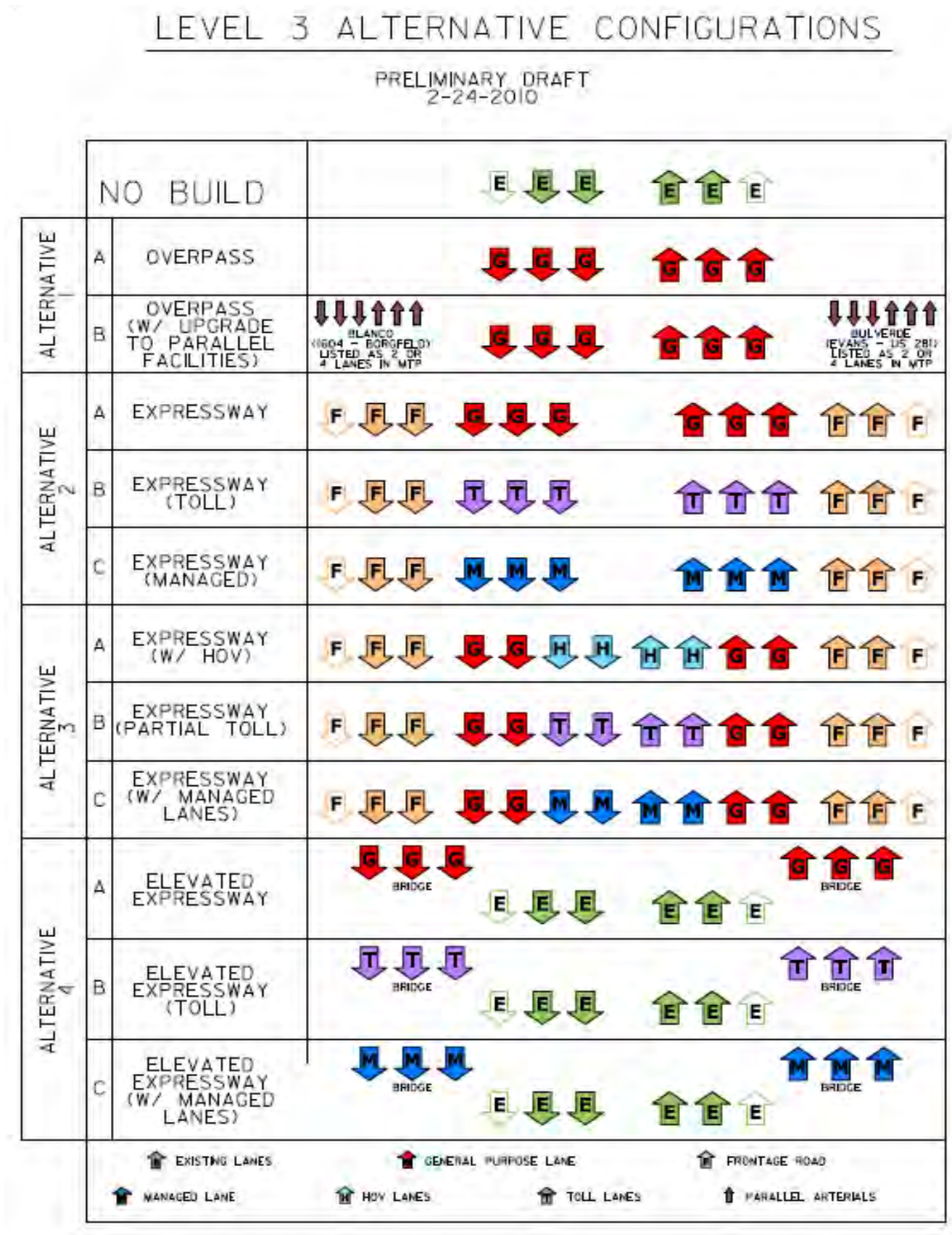


Source: MPO Travel Demand Model, 2009, US 281 EIS Team, 2010

1.3.5 Level 3 2035 Build Networks

Level 2 alternatives were refined and altered to form the set of alternatives for analysis in Level 3 screening. **Figure 8** displays a summary of the Level 3 alternative roadway cross-section configurations for the US 281 project corridor. Some alternatives required several iterations of coding refinements to produce reasonable results. The description of Level 3 model run iterations is provided in **Table 2**.

1 **Figure 8: Level 3 US 281 Corridor Configurations**



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3 Source: US 281 EIS Team, 2010

Table 2: Level 3 Alternative Model Runs

Run Name	Short Name	Coded starting with	O-D Table	Improvements	Date
US-281_Alternative 0 T+I No Build	0	2035 SAM	2035 T+I	No Build. Coded with simple node intersections	2/1/2010
US-281_Alternative 1B T+I Overpass + UPA	1B	Alternative 0	2035 T+I	Added interchanges at each intersection. Upgraded sections of the roadway to Freeway. Set capacity to 1500 vph. Bulverde and Blanco widened to 6 lanes.	2/4/2010
US-281_Alternative 1A T+I Overpass (4 Lane)	1A	Alternative 1 (prior)	2035 T+I	Bulverde and Blanco coded to match Alternative 0.	2/18/2010
US-281_Alternative 1D T+I Overpass (8 Lane)	1D	Alternative 1B (prior)	2035 T+I	Increase US-281 to 8 Lanes	2/18/2010
US-281_Alternative 1E T+I Overpass (10 Lane)	1E	Alternative 1B (prior)	2035 T+I	Increase US-281 to 10 Lanes	2/18/2010
US-281_Alternative 1C T+I Overpass (4 & 6 Lane)	1C	Alternative 1A (new)	2035 T+I	US-281 6 lanes to Stone Oak, 4 lanes to Borgfeld, no upgrades to parallel arterials	
US-281_Alternative 2A T+I Expressway (FREE)	2A	Alternative 0	2035 T+I	Coded to match Expressway Alternative from Austin. Coded mainline as General Purpose.	2/1/2010
US-281_Alternative 2B T+I Expressway (TOLL)	2B	Alternative 2A	2035 T+I	Coded mainline as toll.	
US-281_Alternative 2C T+I Expressway (HOT)	2C	Alternative 2A	2035 T+I	Coded to match HOT lane coding of 4C	2/18/2010
US-281_Alternative 2C-1 T+I Expressway (HOT)	2C-1	Alternative 2C	2035 T+I Factored for HOV	Ran with Matrix reduced by 78% to account for HOV	
US-281_Alternative 3A T+I Expressway + MGD (FREE)	3A	Alternative 2A	2035 T+I	Added express lanes, coded as General Purpose.	2/1/2010
US-281_Alternative 3A-1 T+I Expressway + MGD (FREE)	3A-1	Alternative 3A	2035 T+I Factored for HOV	Ran with Matrix reduced by 78% to account for HOV	2/17/10
US-281_Alternative 3B T+I Expressway + MGD (TOLL)	3B	Alternative 2A	2035 T+I	Added express lanes, coded as toll.	1/28/2010
US-281_Alternative 3C T+I Expressway + MGD (HOT)	3C	Alternative 2A	2035 T+I	Added express lanes, coded as HOT (overridden capacity of 1500 vph).	2/3/2010
US-281_Alternative 3C-1 T+I Expressway + MGD (HOT)	3C-1	Alternative 3C	2035 T+I Factored for HOV	Ran with factored Matrix to account for HOV	
US-281_Alternative 4A T+I Managed (FREE)	4A	Alternative 0	2035 T+I	Coded to match Alternative 3A from Austin. Coded expressway as General Purpose.	2/3/2010
US-281_Alternative 4B T+I Managed (TOLL)	4B	Alternative 0	2035 T+I	Coded to match Alternative 3A from Austin. Coded expressway as toll.	2/1/2010
US-281_Alternative 4C T+I Managed (HOT)	4C	Alternative 0	2035 T+I	Coded to match Alternative 3A from Austin. Coded expressway as HOT (overridden capacity of 1500 vph).	2/3/2010

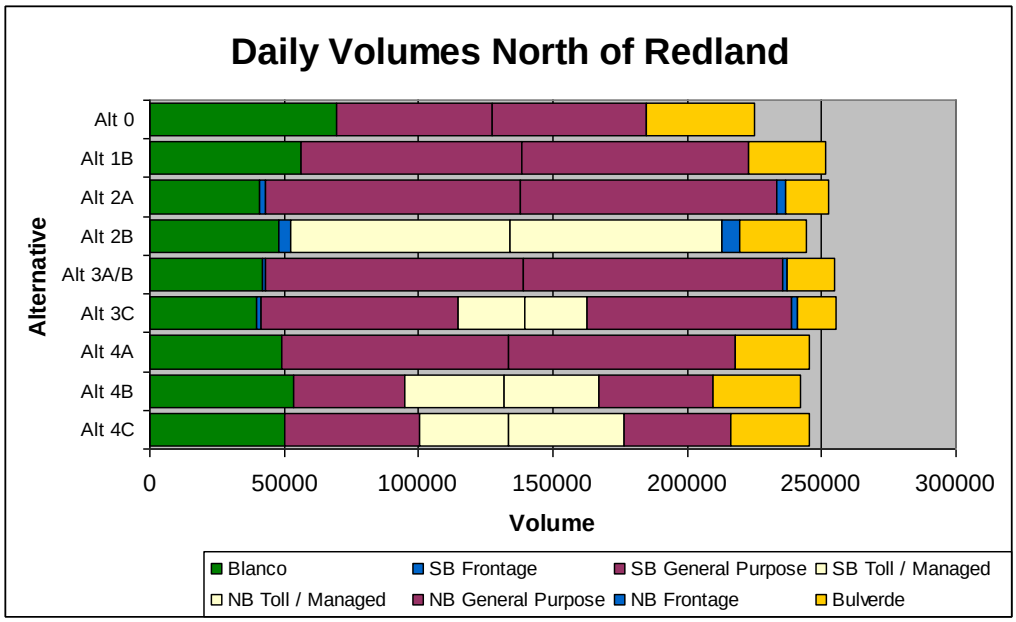
Run Name	Short Name	Coded starting with	O-D Table	Improvements	Date
US-281_Alternative 4C-1 T+I Managed (HOT)	4C-1	Alternative 4C	2035 T+I Factored for HOV	Ran with factored Matrix to account for HOV	
US-281_Alternative 2C-2 T+I Expressway (HOT)	2C-2	Alternative 2C-1	2035 T+I Factored for HOV	Ran with reduced HOV capacity to see if VMT would be increased. It was not.	3/8/2010
US-281_Alternative 2C-2 T+I Expressway (HOT)	2C-2	Alternative 2C-1	2035 T+I Factored for HOV	Ran with new Trip Table 3k to see if VMT would be increased. It was.	3/8/2010
US-281_Alternative 2C-2 T+I Expressway (HOT)	2C-2	Alternative 2C-1	2035 T+I Factored for HOV	Ran with new Trip Table 3k, and 50 iterations to see if we get different results with more iterations.	3/8/2010
US-281_Alternative 2C-1 (2k Trip Table)	2C-1	Alternative 2C-1	2035 T+I Factored for HOV	Ran with Trip Table 2k.	3/9/2010
US-281_Alternative 4C-1 (2.5k MTX)	4C-1	Alternative 4C		Ran with Trip Table 2k.	3/10/2010
	2A	Alternative 2A		Corrected network coding – didn't change results.	3/9/2010
	4A	Alternative 4A		Corrected network coding – didn't change results.	3/9/2010
	4A			Re-ran with the new QC'd model.	
	4B			Re-ran with the new QC'd model.	
	4C			Re-ran with the new QC'd model	
US-281_Alternative 2C-1 (2.5k Trip Table)	2C	Alternative 2C-1		Ran with Trip Table 2.5k.	
US-281_Alternative 4C-1 (2.5k MTX)	4C	Alternative 4C-1		Ran with Trip Table 2.5k.	

Source: US 281 EIS Team, 2010

1.3.6 Level 3 Results

Level 3 modeling aided in the development of DRAFT EIS alternatives by providing more specific results. A summary of daily volumes north of Redland for the Corridor as well as parallel arterials for the Level 3 alternatives is presented in **Table 3**. In preparation of the alternatives screening, travel model results were adjusted as necessary for reasonableness. **Table 3** contains the measures of effectiveness for Level 3.

Figure 9: Level 3 Daily Traffic Projections



Source: MPO Travel Demand Model, 2009, US 281 EIS Team, 2010

Table 3: Detailed Level 3 Measures of Effectiveness

Level 3 Criteria	Existing	Alternatives								
		2035								
		No Build	Overpass/ Expansion	Overpass/ Expansion & Widen Blanco Rd. & Bulverde Rd.	Expressway			Elevated Expressway		
					Non Toll	Toll	Managed	Non Toll	Toll	Managed
Average Peak Hour Speed (mph) - Corridor										
U.S. 281 Corridor - All Lane Types	25	5	20	20	40			30		
U.S. 281 Corridor - Main lanes only	25	5	20	20	45			45		
Average Daily Traffic (000s)										
South of Bulverde - U.S. 281 Corridor	40	75	120	105	130	120	120	125	115	115
South of Bulverde - Blanco + Bulverde	20	45	30	40	20	25	25	20	25	25
North of Sonterra - U.S. 281 Corridor	90	115	170	165	210	185	180	170	160	160
North of Sonterra - Blanco + Bulverde	40	110	90	100	70	85	85	90	95	95
LOS along U.S. 281 Corridor - Percent of Centerline miles										
LOS A, B, C, or D	10%	5%	20%	35%	70%			60%		
LOS E	0%	0%	20%	5%	15%			10%		
LOS F	90%	95%	60%	60%	15%			30%		
LOS along Parallel Facilities (Bulverde and Blanco) - Percent of Centerline miles										
LOS A, B, C, or D	65%	5%	5%	45%	50%			30%		
LOS E	10%	0%	55%	5%	10%			25%		
LOS F	25%	95%	40%	50%	40%			45%		
Daily Miles of Travel - Regional										
Change in Vehicle Miles of Travel (VMT) compared to 2035 No Build- (000s)	N/A	0	40	-40	-140	-110	-200	-110	-90	-160
Daily Hours of Travel - Regional										
Change in Vehicle Hours of Travel (VHT) compared to 2035 No Build- (000s)	N/A	0	-80	-90	-100	-100	-130	-80	-80	-110
April 29, 2010										

Source: MPO Travel Demand Model, 2009, US 281 EIS Team, 2010

1.4 DRAFT EIS MODELING

This section describes the modeling performed for the Draft EIS alternatives screening.

1.4.1 Source Travel Model

The MPO updated the travel demand model prior to the time period of Draft EIS screening. The improvements included changes to the volume delay functions utilized in the model to reflect more realistic conditions on congested roads, but made little or no changes to the network. The MPO transmitted new 2035 trip tables and networks on June 3, 2010. The trip tables created by the MPO reflected the adopted 2035 socioeconomic data scenario (TOD + Infill) for the region. The overall number of regional trips in 2035 remained approximately the same as for Level 2 and 3 screening.

1.4.2 2035 No-Build Network Model

The new network received from the MPO was reviewed to ensure that no new projects were included in the vicinity of the study area. Then the No Build model forecast was performed with the updated volume-delay functions and trip tables.

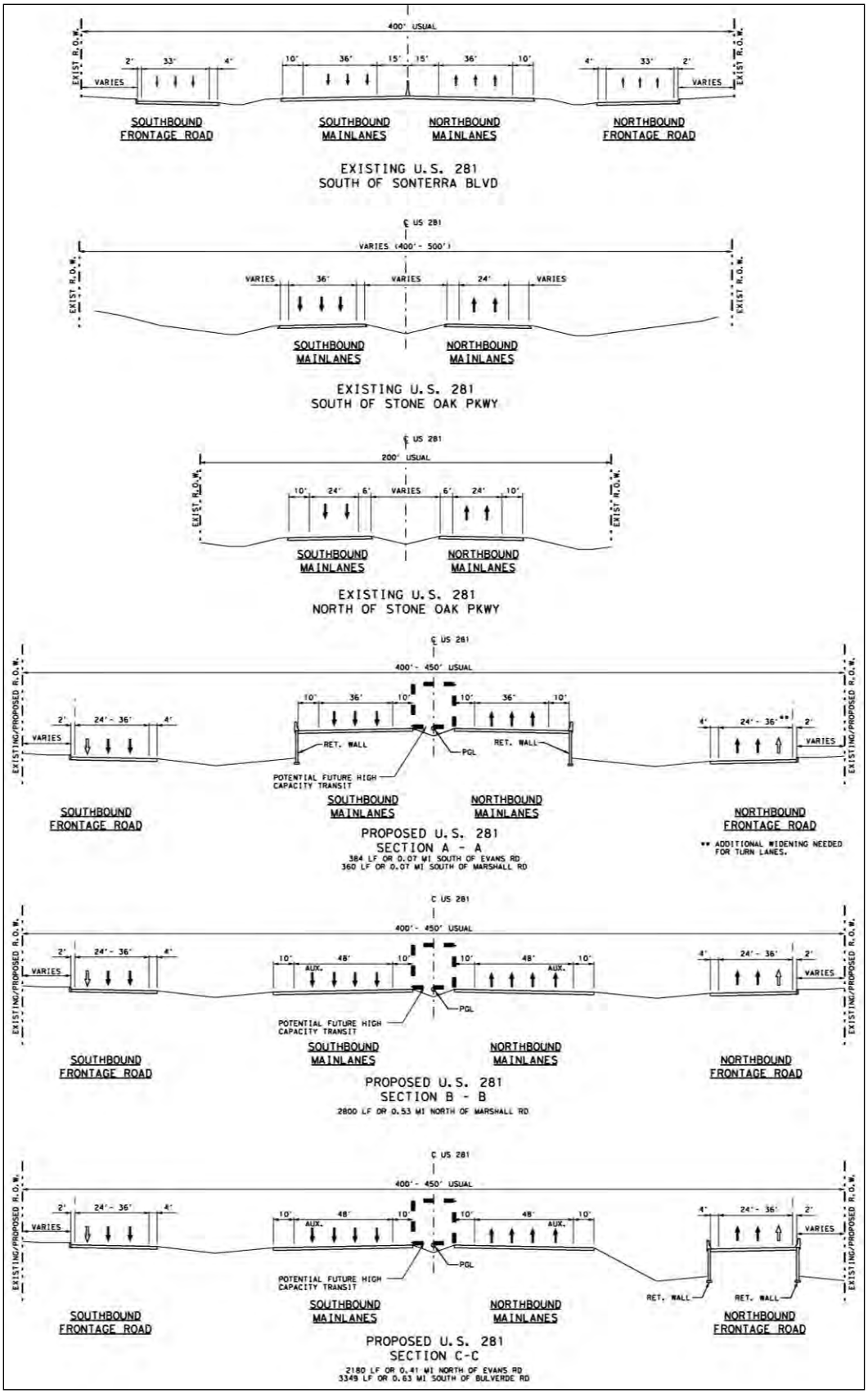
1.4.3 2035 Build Networks

The 2035 Draft EIS Build networks were coded for the Draft EIS Proposed Build Alternatives using Level 3 alternatives as a base.
The Draft EIS Proposed Build Alternatives are described below:

- **Expressway Alternative (Figure 10)**
  This alternative would include frontage roads and an expressway with 3 through lanes plus auxiliary lanes in each direction for most of the US 281 project corridor. It includes 3 options for the mainline lanes:
    - Non-toll – This option was coded with free expressway lanes for the mainline.
    - Toll – This option was coded as toll expressway lanes, with toll costs of $0.15 per mile for autos and $0.40 per mile for trucks according to guidance from the MPO.
    - Managed Lanes – This option was coded with toll expressway lanes to simulate the availability of the lanes to toll vehicles. However, because HOV vehicles would also be able to use the facility, the toll cost was reduced to $0.08 per mile for autos (thus attracting more vehicles to the lanes). Also, about 2,500 trips that use the US 281 project corridor were reduced from the trip table to account for the increased amount of carpooling.

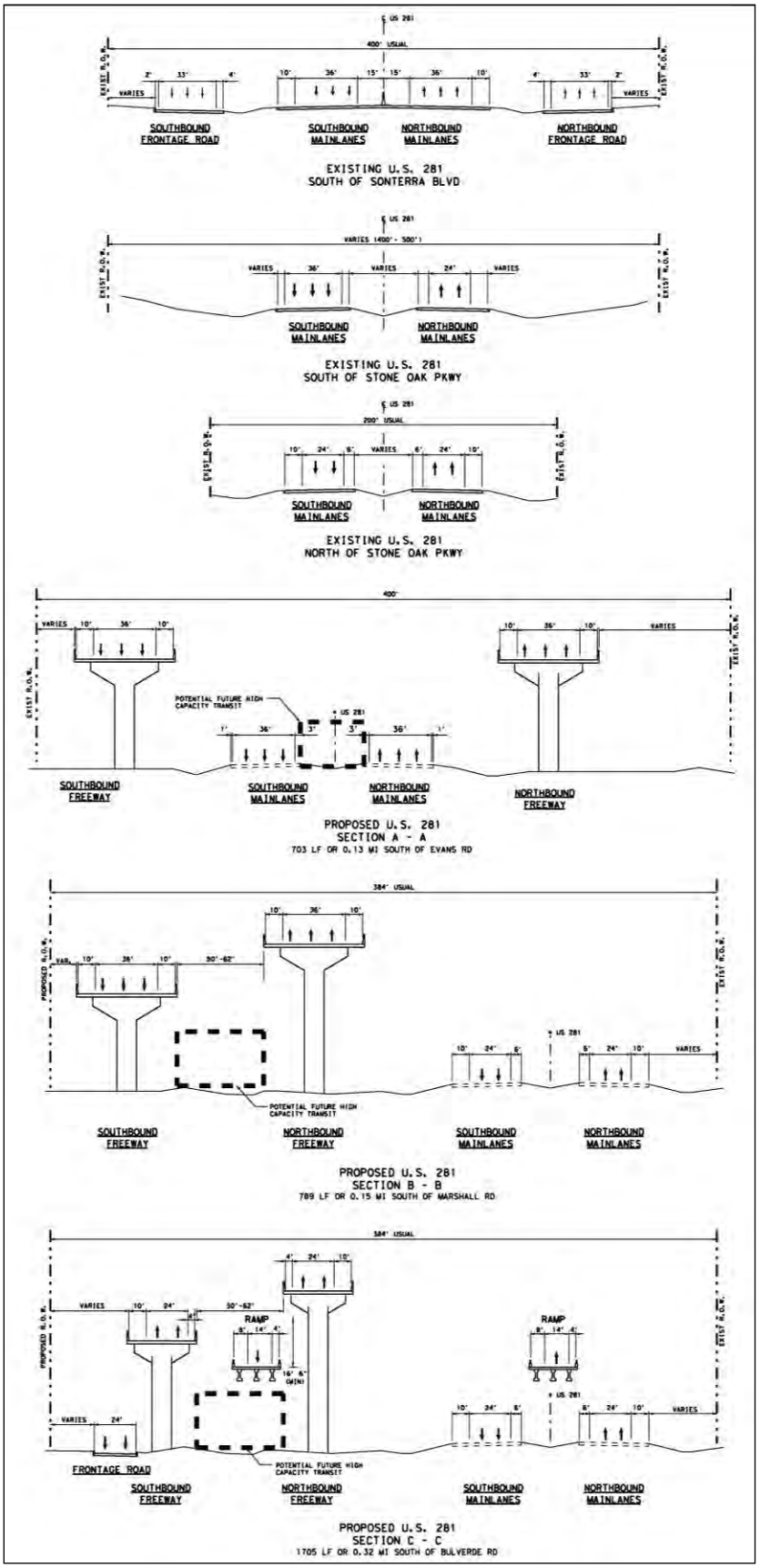
- **Elevated Expressway Alternative (Figure 11)**
  This alternative would be adjacent to the existing US 281 project corridor and would include an elevated expressway with 3 through lanes for most of the corridor. It includes 3 options for the mainline lanes:
    - Non-toll – This option was coded with free expressway lanes for the mainline.
    - Toll – This option was coded as toll expressway lanes, with toll costs of $0.15 per mile for autos and $0.40 per mile for trucks according to guidance from the MPO.
    - Managed Lanes – This option was coded with toll expressway lanes to simulate the availability of the lanes to toll vehicles. However, because HOV vehicles would also be able to use the facility, the toll cost was reduced to $0.08 per mile for autos (thus attracting more vehicles to the lanes). Also, about 2,500 trips that use the US 281 project corridor were reduced from the trip table to account for the increased amount of carpooling.

Figure 10: Draft EIS Expressway Alternative Cross Sections



Source: US 281 EIS Team, 2010

Figure 11: Draft EIS Elevated Expressway Alternative Cross Sections

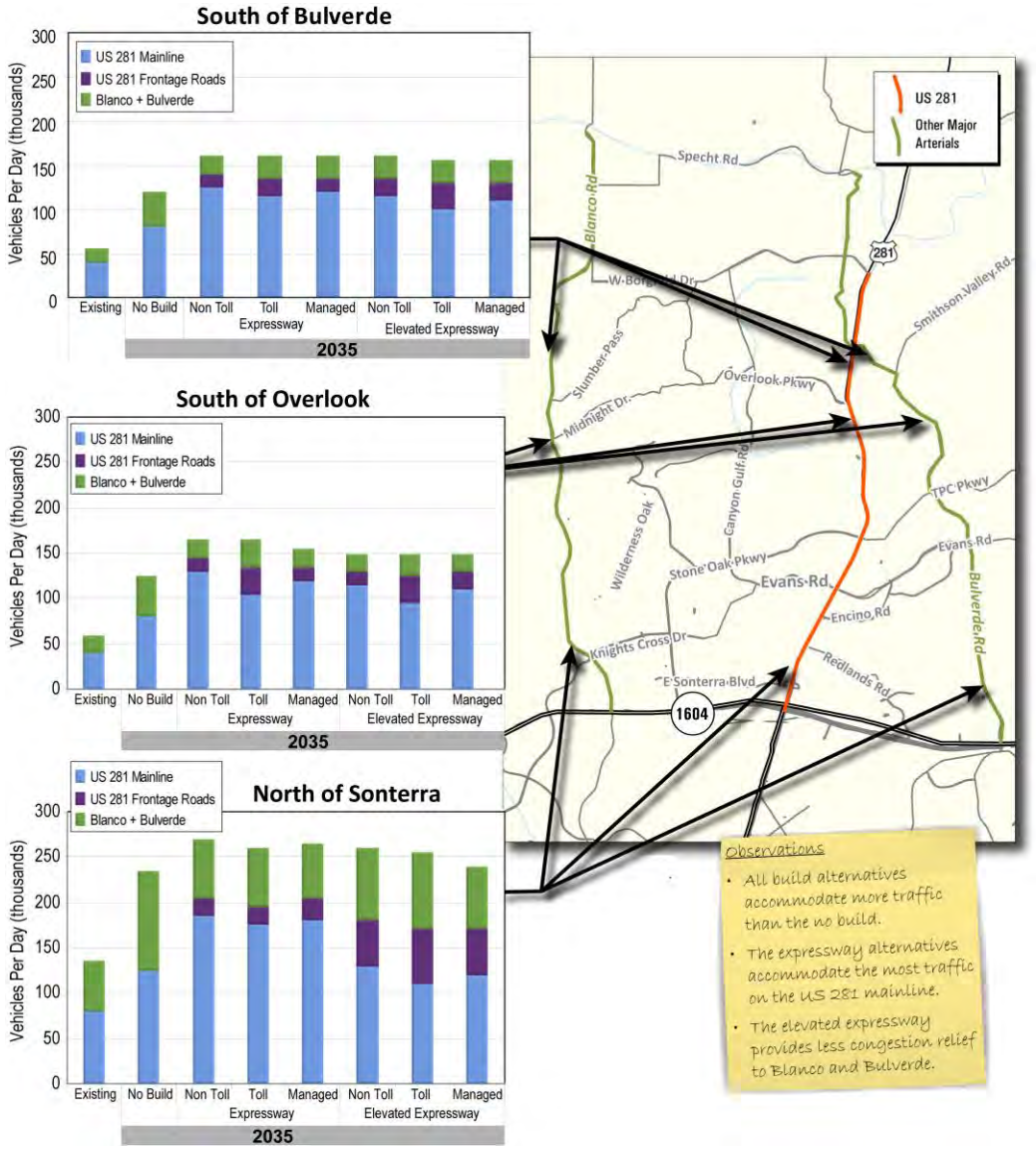


Source: US 281 EIS Team, 2010

1.4.4 Draft EIS Results

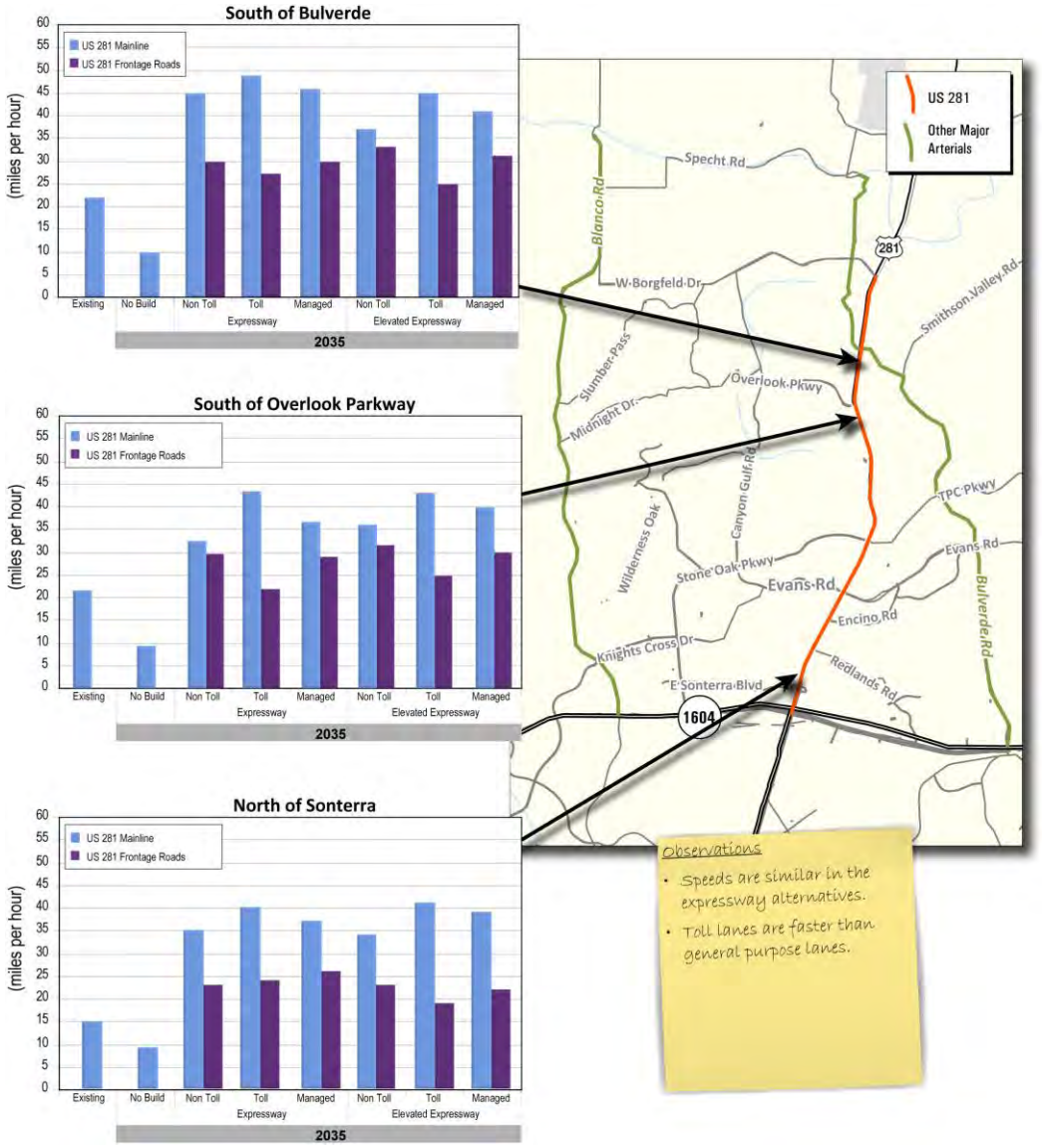
The summary results of the Draft EIS modeling are presented in **Figure 12**, **Figure 13**, **Figure 14**, and **Table 4**.

Figure 12: Average Daily Traffic by Alternative



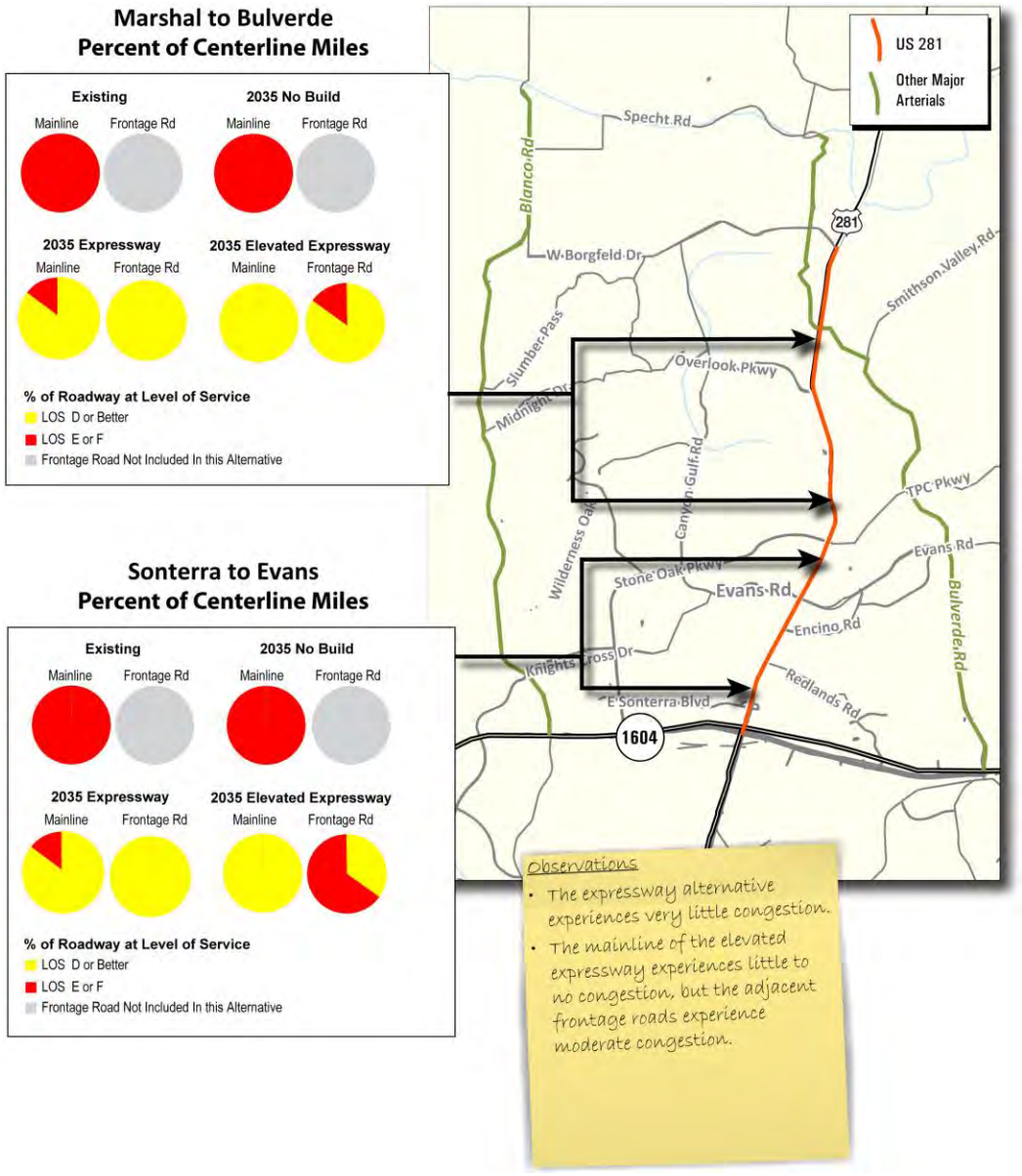
Source: US 281 EIS Team, 2010

Figure 13: Average Peak Hour Speed by Alternative



Source: US 281 EIS Team, 2010

Figure 14: Level of Service by Alternative



Source: US 281 EIS Team, 2010

Table 4: Detailed Draft EIS Travel Demand Measures of Effectiveness

Level 3 Criteria	Existing	Alternatives						
		2035						
		No Build	Expressway			Elevated Expressway		
			Non-Toll	Toll	Managed	Non Toll	Toll	Managed
Average Peak Hour Speed (mph) - Corridor								
South of Bulverde - US 281 Mainline	22	10	45	49	46	37	45	41
South of Bulverde - US 281 Frontage Roads	-	-	30	28	30	33	25	31
North of Sonterra - US 281 Mainline	15	9	35	40	37	34	41	39
North of Sonterra - US 281 Frontage Roads	-	-	23	24	26	23	19	22
Average Daily Traffic (000s)								
South of Bulverde - US 281 Mainline	40	80	125	115	120	115	100	110
South of Bulverde - US 281 Frontage Roads	-	-	15	20	15	20	30	20
South of Bulverde - Blanco + Bulverde	15	40	20	25	25	25	25	25
North of Sonterra - US 281 Mainline	80	125	185	175	180	130	110	120
North of Sonterra - US 281 Frontage Roads	-	-	20	20	25	50	60	50
North of Sonterra - Blanco + Bulverde	55	110	65	65	60	80	85	70
LOS along U.S. 281 Corridor - Mainline - Percent of Centerline miles								
LOS D or Better	25%	0%	75%	75%		80%		
LOS E or F	75%	100%	25%	25%		20%		
LOS along U.S. 281 Corridor - Frontage Roads - Percent of Centerline miles								
LOS D or Better	-	-	100%	100%		75%		
LOS E or F	-	-	0%	0%		25%		
LOS along Parallel Facilities (Bulverde and Blanco) - Percent of Centerline miles								
LOS D or Better	75%	0%	90%	90%		70%		
LOS E or F	25%	100%	10%	10%		30%		

Source: MPO Travel Demand Model, 2009, US 281 EIS Team, 2011

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